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August 4, 2010

Anthony Marconi, P.E.
Preventive Maintenance and Support Services Manager
Louisville MSD
3050 Commerce Center Place
Louisville, KY 40211-1972

Re: Task 3.0: Phase I Site Evaluation of Landfill Gas Collection System
Lee's Lane Landfill Superfund Site
Louisville, Kentucky
EPA ID: KYD980557052

Dear Mr. Marconi:

This memorandum summarizes the first phase of the site inspection conducted by Smith Management Group (SMG) to assess the landfill gas (LFG) collection system at Lee's Lane Landfill. In this first phase of the inspection, SMG was contracted by Louisville and Jefferson County Municipal Sewer District (MSD) to visually assess the overall condition of the blower equipment, headers and well moisture traps of the LFG collection system. The blower house was inspected to determine if the current gauging instrumentation can be used to evaluate the efficiency of the system scoped for Phase II, or if other methodologies will be necessary.

Lee's Lane Landfill is located west of Louisville, Kentucky along the southern bank of the Ohio River. The LFG collection system for Lee's Lane Landfill was installed in October of 1980 to mitigate the subsurface migration of methane gas from the landfill to the adjacent residential neighborhood of Riverside Gardens. A summary of previous site evaluations of the LFG collection system conducted since 1993 have been provided to identify recurring issues and unsuccessful repairs that will be useful for issuing an informed recommendation for future actions.

SCS Engineers designed the system which consists of 31 vertical extraction wells, moisture trap wells, connecting piping, and a 10-horsepower blower for ventilating the captured gases to the atmosphere. The LFG collection system and the blower house equipment have been maintained by Louisville MSD staff since 1986. Five-Year Reviews have been conducted to evaluate the condition and performance of the LFG collection system at Lee's Lane Landfill since 1993.

1405 Mercer Road
Lexington, KY 40511

(859) 231-8936
Fax (859) 231-8997
http://www.smithmanage.com

Previous Assessments of the Gas Collection System

The first of the Five-Year Reviews (FYR) was conducted in 1993 by Resource Applications, Inc. and noted several deficiencies that had developed in the maintenance and operation of the LFG collection system. The 1993 FYR noted heavy vegetation growth that hampered visual inspection efforts, but as this memo will address, this seemingly minor impact may be a contributing factor to the poor condition of several wells observed in 2009. They also described broken concrete well pads (or collars) that prevented effective operation of the gas collection system. Other impacts observed included unauthorized vehicular access and erosion damage caused by all-terrain vehicles.

The second FYR conducted in 1998 by Roy F. Weston, Inc. found the landfill was still producing methane and other gases. The reviewers recommended that ambient air and gas well sampling should be continued on a quarterly basis in accordance with the April 1991 Operations and Maintenance (O&M) Plan. They recommended routine O&M of the LFG collection system should include quarterly inspections of groundwater and gas monitor wells to ensure each well is locked and that vandalism or damage has not occurred. The reviewers found the entrance gate was not locked and recommended more fencing between the site and adjacent residential properties to restrict all-terrain vehicular traffic. They also observed subsidence along the access road and recommended backfilling the depressions with low hydraulic conductivity material to decrease the chance of percolation of surface water through the buried waste. Lastly, they noted overgrown grass cover that should be mowed to reduce surface water percolation.

The third FYR conducted in 2003 by the U.S. Army Corps of Engineers recommended improvements to drainage along header lines, blocked ditches, and drain pipe under access road. Based on the drainage conditions and obstructions in the gas collection system, they also recommended a complete re-evaluation of the subsurface gas collection system.

The most recent FYR conducted in 2008 by the U.S. Army Corps of Engineers found deteriorating condition of the LFG collection system and recommended repair and maintenance of the LFG collection system. They found increasing methane levels in monitoring well G-1; however, levels of methane at all other gas monitoring wells was found to be well below the 10% lower explosive limit (LEL). Similar to previous FYR reports, the reviewers recommended a re-evaluation and improvement to site-access restrictions that should limit trespassing by pedestrians and ATV traffic.

Prior to the 2008 FYR, SCS Engineering performed a site evaluation of the gas collection system in February of 2004. SCS Engineering concluded the majority of the extraction wells were not being influenced by the blower system. The

gauge reading for the blower inlet registered 46.7 inches of water column vacuum pressure, and 0.0 inches of water column vacuum pressure for the blower outlet. Pressure readings for the north and south header lines were 20.1 and 20.0 inches of water column vacuum pressure, respectively. They recommended that the cause of the high pressure drop between the blower suction line and the north and south header lines should be determined and corrected. They suggested this pressure drop could indicate that the inline filter and flame arrestors require maintenance.

SCS Engineering determined there were blockages in the north and south header lines as well as excess water in the extraction wells. Efforts were taken to temporarily ameliorate the blockages by installing above-grade jumper lines to bypass gases around the obstructed sections of the header lines. However, there were only marginal improvements to the performance of the northern and southern header lines indicating there are likely more blockages or breakages upstream of those identified. Based on these findings, SCS concluded it would not be cost effective for MSD to investigate further into probable locations of damage since the system has exceeded the typical 25-year useful life for LFG collection systems and was, and continues to be, in need of repairs. Their investigation also found that 25 of the 31 extraction wells had water levels sufficient enough to block the perforations in the well pipe, which causes a barrier to gas migration from the surrounding media.

Similar to the 2008 FYR, SCS Engineering collected air samples from four of the five LFG probe locations on the site in 2004 and found concentrations of methane in probe G1 that ranged from 5.3 to 7.5 percent. These concentrations exceed the lower explosive limit for methane. This finding supported their recommendation that a phased construction approach should be implemented to replace sections of the header lines believed to be failing. Once replaced, these sections of the system should be re-evaluated to determine the effectiveness of the improvement to the system. SCS Engineering also recommended pumping water from the extraction wells to restore the gas extraction functionality of the wells and to avoid replacing the wells. Furthermore, they recommended reducing the slope of the collection header pipe from 4 percent to 1 percent, which could reduce the number of moisture traps needed. SCS estimated in the 2004 report that it would cost a maximum of $327,750 to install new extraction wells and repair the system. SMG found no indications from direct field observations or the 2008 FYR to indicate that these recommended repairs, replacement or maintenance of LFG collection system components were implemented.

The results and recommendations from previous evaluations of the LFG collection system provides an indication of where issues have been identified, which is critical for making informed decisions for corrective actions.

SMG Assessment of the Gas Collection System

SMG conducted successive site evaluations of the Lee's Lane LFG collection system on October 8th and November 6th of 2009. As previously mentioned, these inspections were conducted to visually assess the overall condition of the blower equipment, headers and well moisture traps of the LFG collection system.

Blower System Assessment

The blower house was inspected to determine if the current gauging instrumentation can be used to evaluate the efficiency of the system scoped for Phase II. The blower system is located between two series of header lines to the north and to the south. Initial gauge readings for the north and south header lines were collected prior to starting the system. The static vacuum gauge reading for the northern header line registered less than 0.0 inch of water column vacuum and the gauge for the southern header line registered approximately 1.0 inch of water column vacuum. The discharge pressure gauge, which measures pressure in pounds per square inch (psi), registered less than 0.0 psi.

After recording the static measurements on the northern header line, southern header line, and discharge gauges, the system was engaged to verify the system provides sufficient suction to mitigate landfill methane levels. When the blower system was started, the belts on the drive motor appeared to slip slightly, but then operated fine once the motor reached full operating speed. There did not appear to be any other unusual vibrations or noises from the motor, blower, or piping inside the blower room.

The blower system was allowed to run for about 15 minutes to build effective suction throughout the system. Once the pressure was established, the north header gauge registered 1 inch of water column vacuum, the south header gauge registered 2.5 inches of water column vacuum, and the discharge gauge registered less than 0.0 psi. The butterfly valves on each portion of the system were manipulated to test the individual suction on the north and south header lines of the system. The butterfly valve to the north header line was closed while the system was operating and the gauge for the south header line registered 12 inches of water column vacuum. The same test was run by closing the south header line and opening the north header line. During this test, the gauge on the north header registered 1 inch of water column vacuum. The discharge gauge was observed during both of these tests and there was not an increase in pressure during either test.

Comparing these pressures to those obtained in the 2004 SCS evaluation indicate a reduction in vacuum pressure of about 95% for the north header line and 87% for the south header line. Therefore, inspection of the blower system indicates the following:

1) The discharge pressure gauge needs to be checked to determine if replacement is necessary, since no pressure change was observed on the gauge.
2) The difference in vacuum pressures between the north and south header inlets, and the reduction in vacuum pressure from the 2004 assessment, indicate that replacement of the inline filters and flame arrestors is required to properly operate the blower system.

Based on the observations of previous assessments, the current observations by SMG, and the 29-year age of the gas collection system, SMG recommends the replacement of the discharge pressure gauge and the inline filters and flame arrestors associated with the north and south header lines of the blower system. A follow-up evaluation of the blower system should be performed subsequent to replacing these components to determine if the efficiency of the blower unit warrants replacement.

Extraction Well System
After concluding the evaluation of the blower system, SMG started collecting observations of the gas extraction wells, moisture traps wells, and valve boxes along the south and north header lines. The inspection of each well required more time than anticipated due in part to the overgrown condition of the grass around each well. Some of the well covers for valve boxes were covered up to 6 inches with soil, and required digging to expose them.

There were several issues observed while conducting the site evaluation of the gas extraction and moisture trap wells. The most glaring was that many of the wells were covered with vegetation and even soil. This is likely a contributing factor to the presence of excess water in the gas extraction wells. The predominant vegetative cover on the landfill site is grass. When the grass gets too tall it dies and becomes matted to the ground and over the top of the well covers. As it biodegrades it turns into soil, which was observed on some well covers to a depth of six inches. Excessive vegetation also retains moisture from rainfall around the well cover, which can infiltrate directly into the well. This vegetation and debris can also form drainage obstructions that cause ponding in the vicinity of the well heads. Regular maintenance of vegetation around the well heads is essential to maintaining positive drainage and providing easier access to effectively monitor well conditions.

SMG attempted to locate and measure the amount of water accumulated in the moisture traps at wells numbered 17 and 26, where blockages were previously identified in the 2004 assessment. Moisture trap (MT-17) was located and the depth to water was measured, but MT-26 could not be located due to the overgrown conditions of the grass on the site. The water level in MT-17 was measured 3.54 feet below the top of the casing and the total depth of the well

was 9 feet from the top of the casing. Comparing this water level with the construction diagrams indicated that the water will impede collection of landfill gas in the header upstream of this moisture trap. Therefore, this negates the functionality upstream of MT-16.

Of the 31 monitoring and moisture trap wells, most were observed in good or fair condition. Field observations of monitoring well and moisture trap well conditions are provided in the attached Tables 1 and 2, respectively. Five of the extraction wells and three of the moisture trap wells could not be located. Six casing structures for the extraction wells and six casing structures for the moisture trap wells had identifiable damage that will require repair or replacement. The need for replacement of particular wells indicates the deteriorated state of the LFG collection system. It was also evident that maintenance efforts for Lee's Lane Landfill must be re-evaluated, especially in regard to controlling vegetative overgrowth.

General Assessment of Landfill Gas Generation
According to the previous 2008 FYR of the Lee's Lane Landfill, domestic, commercial and industrial wastes were disposed at the site from the late 1940s through 1975. In 1975 methane gas and flash fires occurred in some homes in the Riverside Gardens subdivision. The 2008 FYR reported that 1975 was the year the landfill was closed. Based on closure of the landfill in 1975, the methane generation would have peaked in 1976 based on the EPA landfill gas generation model (LANDGEM) lending support to methane gas migration to the adjacent subdivision in 1975. Since it has been approximately 35 years that the landfill was closed, the methane gas generation has been consistently decreasing according to the LANDGEM model. Assuming that the landfill deposited on average 400,000 short tons/year of waste from the late 1940s (assumed 1947 as starting year) through 1975 and assuming LANDGEM default model parameters for a conventional landfill are correct, the methane generated from the landfill would be approximately 582.3 ft^3/min. Compared to the peak of 3,187 ft^3/min in 1976 this represents an 81.7% reduction of annual methane generated by the landfill since the gas migration issue occurred in 1975. To continue to prevent methane gas migration, accumulation in underground structures, or dissolving into groundwater; some landfills, with regulatory approval, begin to transition from active gas collection systems to either a passive vent system or landfill gas monitoring once the landfill has been closed for 30 years or more.

Conclusions
Based on the 29-year age of the gas collection system, observations from the 2004 assessment by SCS Engineers, and results of the current assessment, SMG concludes that the current system is inoperable and has exceeded the useful life of the system.

Using the SCS estimated cost to install new extraction wells to repair the gas collection system and adjusting for inflation using the CPI Inflation Calculator posted by the United States Department of Labor, Bureau of Labor Statistics at URL: http://www.bls.gov/data/inflation_calculator.htm, the current cost to install new extraction wells and repair the system would be approximately $378,548.

Since the landfill last deposited waste approximately 35 years ago, methane has been recorded above the LEL in gas monitoring well G-1 at various times within the last six years but more recent sampling has reported no methane in the well, and no methane above the LEL has been reported in the other gas monitoring wells, G-2 through G-5. Therefore, SMG recommends that three additional gas monitoring wells be installed in the area of G-1 to verify if methane is migrating from the landfill, since the operability of well G-1 is uncertain. These wells should be permanently added to the quarterly gas well monitoring program as soon as they are developed. Lastly, SMG recommends that a report be prepared once two quarters worth of sampling of the new wells has been completed to determine if the landfill gas collection system is still required to control methane gas migration from the landfill.

If you have any questions concerning this matter, please do not hesitate to contact me at 859-231-8936.

Sincerely,
Smith Management Group

Kyle R. Hagen, P.E.
Project Engineer
kyleh@smithmanage.com

Table 1 – Observations from Inspection of Monitoring Wells

Well Number	Date	Condition	Observations
W-1	9/8/2009	Good	Casing, valve box, and vacuum box in good condition
W-2	9/8/2009	Good	Casing, valve box, and vacuum box in good condition
W-3	9/8/2009	Good	Casing, valve box, and vacuum box in good condition
W-4	9/8/2009	Fair	Casing and vacuum box in good condition; Valve box could not be opened due to 5 inches of soil cover
W-5	9/8/2009	Good	Casing, valve box, vault and vacuum box in good condition
W-6	9/8/2009	Poor	Vault good; well missing the ¼-inch plug; vacuum vault good. Could not locate valve box, but it appeared to be covered by gravel road.
W-7	11/6/2009	N/A	Well could not be located
W-8	11/6/2009	N/A	Well could not be located
W-9	11/6/2009	Fair	Well could not be located; Valve box could not be opened
W-10	11/6/2009	N/A	Found well only, no pad
W-11	11/6/2009	N/A	Well could not be located, no marker
W-12	11/6/2009	N/A	Well could not be located
W-13	11/6/2009	Fair	Pad good; Well head good; Could not locate valve
W-14	11/6/2009	Fair	Pad fair; Well head good; One valve box could not be opened
W-15	11/6/2009	Poor	Pad good; Cover could not be opened; Found one valve box with pipe broken off
W-16	11/6/2009	Fair	Pad fair; Could not open cover; No valves located
W-17	11/6/2009	Poor	Pad poor; Could not open cover; One valve box located, fair
W-18	11/6/2009	Fair	Pad fair; Well head good; Found two valve boxes, fair
W-19	11/6/2009	Fair	Pad fair; well head good; No valves located; Location in depression with standing water
W-20	11/6/2009	Fair	Pad fair; Well head good; No valves found
W-21	11/6/2009	Poor	Pad poor; Could not open cover; Found two valve boxes
W-22	11/6/2009	Good	Pad good; Well head good; Found one valve box
W-23	11/6/2009	Fair	Pad fair; Could not open cover; Found one valve box
W-24	11/6/2009	Poor	Pad poor; Well head good; Found one valve without pad
W-25	11/6/2009	Fair	Pad fair; Could not open cover; Two valves found, pads fair, one missing lid
W-26	11/6/2009	Poor	Pad poor, missing top; Well head poor; Found one valve
W-27	11/6/2009	Fair	Pad fair; Could not open cover; No valves found
W-28	11/6/2009	Good	Pad good; Could not open cover; Found no valves
W-29	11/6/2009	Good	Pad good; Well head good; No valves found
W-30	11/6/2009	Fair	Pad fair; Could not open cover; No valves found
W-31	11/6/2009	N/A	Observed from opposite side of fence, but pad appears to be good

Good – Well pad level: has cover: concrete pad in original condition
Fair – Well pad not level: concrete in original condition
Poor – Missing pad entirely: no cover: concrete pad broken
N/A – Not Applicable: well could not be located

Table 2 – Observations from Inspection of Moisture Trap Wells

Well Number	Date	Condition	Observations
MT-1	9/8/2009	Good	Vault located off well line; Well casing good
MT-2	9/8/2009	Good	Vault good; Well casing good
MT-3	9/8/2009	Good	Vault good; Well casing good
MT-4	9/8/2009	Good	Vault good; Well casing good
MT-5	9/8/2009	Good	Vault good; Well casing good
MT-6	9/8/2009	Good	Well pad good; Well head good
MT-7	11/6/2009	Fair	Well pad fair; Could not open well cover
MT-8	11/6/2009	Poor	Pad in poor condition; well head broken
MT-9	11/6/2009	Poor	Well pad poor; Could not open cover
MT-10	11/6/2009	Poor	Found two pads w/ wells and one valve box cover; One well good, other without cover; Well head broken
MT-11	11/6/2009	N/A	Could not confirm to be MT-11; Pad good; Could not open well head
MT-12	11/6/2009	Fair	Pad fair; Could not open well head
MT-13	11/6/2009	Poor	Pad poor; Well head good
MT-14	11/6/2009	Poor	Pad missing; Well head off
MT-15	11/6/2009	Fair	Pad fair; Well head good
MT-16	11/6/2009	Fair	Pad fair; Well head good
MT-17	11/6/2009	Poor	Pad poor; Well head good
MT-18	11/6/2009	Good	Pad good; Well head good
MT-19	11/6/2009	Fair	Pad fair; Could not open
MT-20	11/6/2009	Fair	Pad missing/off; Well head good
MT-21	11/6/2009	Good	Pad good; Could not open
MT-22	11/6/2009	Good	Pad good; could not open cover
MT-23	11/6/2009	Fair	Pad off; Well head fair; Air flowing out of top of well
MT-24	11/6/2009	Good	Pad good; Could not open
MT-25	11/6/2009	Good	Pad good; Well head good
MT-26	11/6/2009	N/A	Could not locate
MT-27	11/6/2009	Fair	Pad fair; Well head good
MT-28	11/6/2009	Poor	Pad poor; Well head poor
MT-29	11/6/2009	Good	Pad good; Well head good
MT-30	11/6/2009	Good	Pad good; Well head good
MT-31	11/6/2009	N/A	Observed from opposite side of fence, but pad appears to be good

Good – Well pad level; has cover; concrete pad in original condition
Fair – Well pad not level; concrete in original condition
Poor – Missing pad entirely; no cover; concrete pad broken
N/A – Not Applicable; well could not be located